26A Campbell Avenue
Normanhurst NSW 2076
30 September 1999

The Institution of Engineers, Australia
SYDNEY DIVISION

Ms Sue Mayrhofer
Administrator
National Committee on Engineering Heritage
The Institution of Engineers, Australia
11 National Circuit
Barton ACT 2600

I.E. Aust. N.O.
- 6 OCT 1999
File........................

Dear Ms Mayrhofer

The Australian Historic Engineering Plaquing Program

Site of BMC/Leyland Australia Manufacturing Plant: Nomination as an Historic Engineering Marker

Herewith are four copies of the submission for the above-mentioned nomination.

The nomination is by the BMC/Leyland Australia Heritage Group, which would like to proceed with the plaquing in March 2000, as part of their celebrations on the 50th year since the plant was opened by Lord Nuffield on 1 March 1950. They have about 400 members and the occasion, which would include a procession of vintage BMC and Leyland vehicles, would provide good publicity for the Plaquing Program.

Should the Plaquing Sub Committee have any queries they might direct them to me and I will take them up with nominating body. I note the proposed citation is about 84 words and may require some final polishing and negotiation with the Group.

The submission includes only one copy of each of the letter of transmission and the nomination form. Having taken advantage of a courier to send this package to Division office whilst he was picking up material from my home, I have been unable to have good copies made of the afore-mentioned documents. It would therefore be appreciated if you would send me three good copies upon receipt of the submissions.

Yours sincerely

Michael Clarke

Michael Clarke

ANENCO Pty. Limited Consulting Engineers

A.C.N. 002 347 604

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21 September 1999

Mr Michael Clarke,
Engineering Heritage Committee, Sydney Division,
The Institution of Engineers Australia,
Engineering House,
11 National Circuit,
BARTON ACT 2600

Dear Michael,

Nomination for Historic Engineering Marker
BMC/Leyland Australia Vehicle Manufacturing Plant
Victoria Park NSW

Attached is our submission for the above. I have prepared 5 complete copies of the document but you may decide to circulate truncated versions - We are happy to leave this to you.

The submission comprises four parts, in descending order of general interest:-

* Executive Summary - 3 pages;

* Appendix 5 - "BMC in Australia - 34 page brochure;

* The body of the submission - 17 pages; and

* Appendices 1 to 4 - bound separately.

If you have any queries, please contact me.

Best wishes,

J.B. Anderson
(Editor, pro tem)

B. M. C.
LEYLAND AUSTRALIA
HERITAGE GROUP

A non-profit association of some hundreds of former employees and interested persons whose mission is to preserve the heritage of B.M.C - Leyland Australia and its associated companies as a significant part of Australia's automotive manufacturing history.

Additional Supporting Information
for
Commemorative Plaque Nomination Form
******
BMC/Leyland Motor Vehicle Manufacturing Facility
Victoria Park, Zetland, NSW - 1950 to 1975

Executive Summary

Provided here is an overview of the information supporting the above nomination submitted to The Institution of Engineers, Australia by the BMC - Leyland Australia Heritage Group whose identity and mission are outlined with its logo above and whose Directory currently lists over 500 ex-employees.

The main body of the document is necessarily extensive in order to do justice to and to adequately explain the significance and extent of BMC's contribution to this country's industrial heritage. Covering the complete third quarter of this century – a little over 25% of the practical history of the automobile - the BMC plant at Zetland was a major Australian automobile manufacturer and the only complete passenger vehicle manufacturer in the history of NSW.

In that time, 1950 to 1975, popular motor cars developed from simple products with few features to complex offerings with most of the customer features we know even now at the turn of the century - automatic transmissions, power steering, air conditioning and radial ply tyres.

In that time, also, safety legislation was enacted which resulted in the introduction of safety systems which remained the basis of the safety sytems of Australian motor vehicles until as recently as 5 years ago - door locks, seat belt anchorages, seat belts, head restraints, barrier crash testing, turn signals and steering column locks.

Towards the end of that period, environmental requirements began to be established with the establishment of early emission controls.

At the end of WW II, Lord Nuffield, who had established the Morris marque worldwide, decided to develop his interests in Australia and purchased the site. The first factory was opened in March 1950 as a Nuffield facility assembling Morris Minor and Oxford cars. The subsequent formation of BMC - the amalgamation of the Nuffield, Austin and Fisher and Ludlow companies - generated the funds to establish

the plant which was manufacturing engines, bodies (from pressings) and complete vehicles within four years of the decision to proceed.

While there is no single feature of the 57 acre (26 hectare) Victoria Park plant that can be said to represent a major breakthrough in automotive technology, the whole period is seen as historically significant to New South Wales as well as to the Australian automotive industry overall.

It was a period of significant technology transfer in which such processes as in-line transfer machines (for cylinder block and cylinder head manufacture), the Rotodip paint process (for priming complete car bodies) Just-In-Time supply principles and Flexible Manufacturing techniques were first seen in Australia.

It was a period in which advanced assembly techniques employing integrated conveyor systems which are still applicable today were introduced as well as the construction of the only fully integrated vehicle manufacturing facility (engines, bodies and assembly on one site) in Australia. BMC was, and still is, the only vehicle manufacturing facility where four, six and eight cylinder engines were manufactured under the one roof.

It was also a period of post war reconstruction and large scale migration. Concurrent with the development of the plant, BMC played a major role in the assimilation of migrants who brought with them their contribution to the development of the Australian culture. There are few such facilities today.

From a commercial viewpoint, after a start in 1950 and expansion during the 1950s, the plant enjoyed a period of good profits in the mid 1960s when it was producing around 1000 vehicles per week. It subsequently faced a gradual reduction in sales success, due to a range of influences, including a model range which was progressively less attractive than its competitors. A number of factors contributed to this, including Government tariff policy which required high volume manufacturers to maintain 95% local content while allowing a relatively large number of companies duty concessions on vehicles imported in numbers up to 7500 per annum.

The main body of the report builds on a brief review of the history of the site since European settlement and its use as a horse racing track. It then traces the site's history from the decision to develop the site, to the construction of the plant, its unique features and its eventual closure in 1975.

Thus, the site and the engineering activities carried out over this period are considered significant from:-

* manufacturing and automotive historical perspectives - eg the world class processes introduced into Australia and the wide range of problems that were faced and solved as well as the vehicle model range involved.

* the viewpoint of the key role BMC played in Australia`s social and cultural development as this period covered post war reconstruction and large scale immigration.

* the aspect of the scale and complexity of the operation. With a workforce of typically 5,000 - peaking at 7000 - on the one site and with enlightened employment policies - needed to cope with employees from 35 nationalities - the BMC/Leyland plant was the largest private employer in the Sydney region.

For these reasons we believe the site and its heritage during the BMC years are worthy of being awarded the Institution's Commemorative Plaque

The document is structured in three parts. This first comprises this Summary, the second is the Listing of Contents with the body of the document and the third is a set of Appendices which give more detailed reviews of some of the processes employed at the site. These are intended to be illustrative of the scope and detail of the work involved during the period and as a record of activities nearly forgotten.

Appendix 5 is a 35 page colour reproduction of a (circa 1958) booklet which includes an Architect`s perspective of the completed plant as planned at the time and many scenes of the plant in action.

Sources of information for the attached document include the Heritage Research Report commissioned by the site Developers, documents and records of the era, experiences and personal contributions of executives, engineers and staff and employees of all levels, who worked at Zetland. A major contributor to this effort was Mr Owen McDonald who was the Planning Engineer responsible for vehicle paint and assembly during a large period of the plant's operation.

Barry Anderson
Roger Foy
Norm Prescott
Roy South

September 1999

Commemorative Plaque Nomination Form

Date. SEPTEMBER 15th, 1999

To:

Commemorative Plaque Sub-Committee
The Institution of Engineers, Australia
Engineering House
11 National Circuit
BARTON ACT 2600

From B.M.C-LEYLAND AUSTRALIA HERITAGE GROUP

Nominating Body

The following work is nominated for a:-

- ~~National Engineering Landmark *~~
- Historic Engineering Marker *

* (delete as appropriate)

Name of work B.M.C./LEYLAND MOTOR VEHICLE MANUFACTURING PLANT

Location, including address and map grid reference if a fixed work VICTORIA PARK, ZETLAND, N.S.W. (MAP REFERENCE: GREGORY'S SYDNEY DIRECTORY - 1998, P375, K10, UBD DIRECTORY - P.19, L3)

Owner (CURRENT) LANDCOM - SOUTH SYDNEY COUNCIL AREA

The owner has been advised of the nomination of the work and has indicated (attach a copy of letter if available) VERBAL AGREEMENT

Access to site

NOW UNDER REDEVELOPMENT — ULTIMATELY ACCESSIBLE AS A PUBLIC AREA

Future care and maintenance of the work ON LISTED HERITAGE SITE UNDER SOUTH SYDNEY COUNCIL

Name of sponsor B.M.C-LEYLAND AUSTRALIA HERITAGE GROUP

For a NEL, is an information plaque required? N/A

Barry Anderson MIEAust, C.P.Eng — Roger Foy J.P. — Prescott C.Eng, M.I.Mech.E. — R. South C.Mech.Eng., BA, MBA

Chairperson of Nominating Committee

D. Cotter per [signature] 30/9/99.

Chairperson of Division Heritage Committee/Panel

PLAQUES8

Additional Supporting Information

Name of work B.M.C./LEYLAND MOTOR VEHICLE MANUFACTURING PLANT

Year of construction or manufacture 1949 ONWARDS

Period of operation 1950 - 1975

Physical condition DEMOLISHED EXCEPT FOR HERITAGE "TOTALIZATOR" BUILDING

Engineering Heritage Significance:-

Technological / scientific value HIGH

Historical value VERY HIGH

Social value VERY HIGH

Landscape or townscape value WAS A SIGNIFICANT, ARCHITECTURALLY DESIGNED INDUSTRIAL SITE.

Rarity WAS THE ONLY COMPLETE MOTOR VEHICLE MANUFACTURING PLANT IN N.S.W.

Representativeness REPRESENTATIVE OF BEST PRACTICE FOR VOLUME MANUFACTURING.

Contribution to the nation or region VERY HIGH IN ECONOMIC AND SOCIAL SENSE.

Contribution to engineering VERY SIGNIFICANT IN TERMS OF TECHNOLOGY TRANSFER & DEVELOPMENT OF ENGINEERING SKILLS.

Persons associated with the work INSTIGATED BY LORD NUFFIELD.

Integrity VERY HIGH

Authenticity VERY HIGH

Comparable works (a) in Australia NO DIRECT EQUIVALENTS AT TIME

(b) overseas VARIOUS IN U.S.A. AND EUROPE

Statement of significance (its location in the supporting documentation) REFER PAGE 2 OF EXECUTIVE SUMMARY

Citation (70 words is optimum) "ON THIS 26 HECTARE SITE THE BRITISH MOTOR CORPORATION/LEYLAND AUSTRALIA MANUFACTURED MOTOR VEHICLES BETWEEN 1950 AND 1975. PIONEERING A PERIOD OF MAJOR POST-WAR RECONSTRUCTION, MIGRANT ASSIMILATION AND TECHNICAL INNOVATION IN AUSTRALIA, IT WAS THE ONLY COMPLETE SUCH PLANT IN NSW, EMPLOYING A PEAK OF 7000 PEOPLE FROM 35 NATIONS. SIGNIFICANT ENGINEERING FEATURES, NEW TO AUSTRALIA INCLUDED: ⊕ FULLY AUTOMATED TRANSFER MACHINING OF CYLINDER BLOCKS ⊕ "ROTODIP" CORROSION PREVENTIVE PAINTING OF CAR BODIES ⊕ "FLEXIBLE" MANUFACTURING WITH AUTOMATIC CONVEYORIZED ASSEMBLY AND "JUST-IN-TIME" SUPPLY PROCESSES.

Attachments to submission (If any)

SEE SUBMISSION COMPRISING: EXECUTIVE SUMMARY, BODY OF SUBMISSION AND 5 APPENDICES

Proposed location of plaque (if not at site) ON SITE - PROPOSED ON HERITAGE "TOTALIZATOR" BUILDING

B. M. C.
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It was also a period of post war reconstruction and large scale migration. Concurrent with the development of the plant, BMC played a major role in the assimilation of migrants who brought with them their contribution to the development of the Australian culture. There are few such facilities today.

From a commercial viewpoint, after a start in 1950 and expansion during the 1950s, the plant enjoyed a period of good profits in the mid 1960s when it was producing around 1000 vehicles per week. It subsequently faced a gradual reduction in sales success, due to a range of influences, including a model range which was progressively less attractive than its competitors. A number of factors contributed to this, including Government tariff policy which required high volume manufacturers to maintain 95% local content while allowing a relatively large number of companies duty concessions on vehicles imported in numbers up to 7500 per annum.

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Thus, the site and the engineering activities carried out over this period are considered significant from:-

* manufacturing and automotive historical perspectives - eg the world class processes introduced into Australia and the wide range of problems that were faced and solved as well as the vehicle model range involved;

* the viewpoint of the key role BMC played in Australia's social and cultural development as this period covered post war reconstruction and large scale immigration. Concurrent with the development of the plant, BMC played a major role in the assimilation of migrants who brought with them their

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Barry Anderson
Roger Foy
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September 1999

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Additional Supporting Information
for
Commemorative Plaque Nomination Form

BMC/Leyland Motor Vehicle Manufacturing Facility
at
Victoria Park 1950 to 1975

INTRODUCTION

This document provides an overview of the vehicle manufacturing activities that took place at Victoria Park near Sydney in New South Wales from 1950 to 1975. It is in support of a Commemorative Plaque Nomination made to The Institution of Engineers, Australia by the BMC/Leyland Australia Heritage Group. It is proposed that a plaquing ceremony take place on the site in March 2000 which will be the 50th anniversary of the opening of the plant and the 25th anniversary of its closure.

Building on a brief review of the history of the site since European settlement and its use as a horse racing track, the history is traced from the immediate post WW2 decision to develop the site as an automotive facility to the establishment of a complete vehicle manufacturing facility in NSW, the construction of the plant, its unique features and its eventual closure in 1975.

The site and the engineering activities carried out over this period are considered significant from:-

* manufacturing and automotive historical perspectives - from the world class processes introduced into Australia and the wide range of problems that were faced and solved to the vehicle model range involved; and

* social viewpoints as this period covered post war reconstruction, large scale immigration and the development of enlightened employment policies.

3. The Totalisator Building.

The only building remaining from the racecourse period is the Totalisator Building which housed a machine which progressively calculated the amount of money bet on each horse and then locked the odds at the beginning of each race. These machines had been introduced into Australia briefly 1879 but were banned in 1883. Legalised again in 1916, the machine installed at the Victoria Park track had been designed and manufactured by Sir George Julius an eminent Australian engineer whose patents were the basis of Automatic Totalisators Ltd.

Originally conceived as a machine for recording votes but rejected by Governments, the company developed the machine for betting and soon sold Australian made "Julius" machines in many countries around the world, the last one continuing in service (at Harringay Stadium, North London) until 1987.

Subsequently Sir Julius was, from 1926, chairman of the Council for Scientific and Industrial Research, and during this time active in establishing both Australian and international standards. In the 1930's he was the prime mover in the establishment of a Division of Aeronautics and in 1938, chairman of the Commonwealth Committee on Secondary Industries Testing and Research. During World War II, he served on the Central Inventions Board, the Australian Council for Aeronautics (as chairman) and the Army Inventions Directorate.

Elected, in 1918, to the first council to preside over the formation of The Institution of Engineers, Australia, he became President in 1925.

4. Wartime and Post War Occupation

The racecourse was resumed for Army purposes and closed in 1942, to reopen in 1945 under the control of the Australian Jockey Club as a training and barrier trials track. Racing operations finally ceased on the site in 1952 after an association of 45 years.

Police horse training and exercising continued on the site until early 1958.

The CKD operation initially used the minimum of Australian components although batteries, tyres, soft trim and paint were locally sourced. Progressively a larger percentage of local content was employed although none of the major parts - body panels, engines, gearboxes, rear axles or suspensions were ever made locally for the CKD operations.

CKD operations continued as the primary output of complete vehicles from the Victoria Park facility until 1958.

7. Formation of BMC.

In 1951, the Nuffield and Austin organisations together with Fisher and Ludlow (a company with large vehicle body facilities) in England merged to form BMC (The British Motor Corporation). In Australia the wholly owned company was The British Motor Corporation of Australia Pty Ltd. Austin had assembly operations Australia in Victoria and the plan involved the rationalisation of the two operations into one at Victoria Park. By 1954, this had taken the form of the use of commonised engines, gearboxes and axles but separate bodies and assembly locations for both Morris (Victoria Park, NSW) and Austin (Victoria). Later in the 1950s, some Austin models were also assembled CKD at Victoria Park.

The major engineering impact on the Victoria Park factory of the BMC merger was the design influence of Austin - all engines, gearboxes and rear axles had an Austin design heritage - while both Austin and Morris body and suspension influences were retained.

8. BMC Site Development

8.1 Overall Plan

The overall plan was the construction of a fully integrated, world class, motor vehicle manufacturing facility on one site which was capable of virtually 100% Australian manufacturing content and which comprised three major factories:-

* The Unit Plant for the manufacture of engines, gearboxes, rear axles and suspension subassemblies;

* The Press Shop for the pressing of body panels and the assembly of body shells; and

* The Car assembly Building (CAB) for the painting of body shells from the Press Shop and the assembly into those shells of the major "Units" from the Unit Plant and the remaining components to be delivered by a range of suppliers.

9. The New Facilities

9.1 The Unit Plant.

This new plant incorporated all the specialised machine tools to manufacture in high volume the specialised components required for passenger vehicles. The list includes:-

Engine: cylinder block, cylinder head, connecting rod, crankshaft, camshaft, push rod, inlet/exhaust manifold and rocker arms and shaft.

Gearbox: Gearbox housing, rear extension, selector forks and rods and clutch withdrawal lever;

Rear Axle: Main axle housing, final drive housing, differential housing, axle shafts, brake drums and installation attachments.

Suspension: Swivel axle, kingpin, pivot joints, control arms, wheel hubs and brake drums and discs.

The factory was equipped with three parallel assembly lines, one for each major sub-assembly together with test running facilities for the completed engines.

Subsequently a small parts paint facility was added using the electrophoretic paint dip process was added.

9.2 The Car Assembly Building.

The CAB incorporated all the material handling and assembly facilities to allow the body shell (Body in White), which arrived from the Press Shop via covered overhead conveyor, to be painted and then assembled into a completed vehicle. The facilities included:-

"Rotodip" body paint machine,

Floor conveyor and indexing system

Four track final assembly line,

Parts receiving and distribution facility,

Parts conveying system including making extensive use of overhead conveyors,

Final test and acceptance facility.

10. Manufacturing Techniques

10.1 Manufacturing Concept.

The Victoria Park plant incorporated the best manufacturing processes and practices known at the time. It was recognised that a balance had to be struck between the economies of dedicated machine tools and the need for flexibility to cope with product development. The need to assemble a range of products on the line with the attendant flexibility of material handling was accommodated. Efficient use of floor space giving the maximum manufacturing capacity with a minimum of material storage space was achieved by "Just-In-Time" (a term not coined until decades later) supply methods (for major items) and modern storage and retrieval techniques.

10.2. Engine Manufacturing.

The most dramatic example of the new techniques employed at Victoria Park was the automatic, in-line, transfer machining of engine (cylinder blocks and heads) and transmission (main case) castings in the Unit Plant. These machines, the first in the Southern Hemisphere, were commissioned in 1956, were over 50 feet long and performed multiple simultaneous operations on components at a number of stations along their length. They required only two operators - one to load and one to unload the components.

The transfer machine concept was developed during World War II in European and North American factories. The novel feature of these machines was that movement between the locations of specific machining functions was automatically sequenced and effected mechanically with up to 50 operations in one line.

The Austin Motor Company in Longbridge was the largest user of these machines in the U.K. at the time and supplied the machines installed in Australia. A group of Longbridge engineers and technicians with special skills migrated to Australia to support this project - a process that would be called "Technology Transfer" today.

Other companies commissioned similar machines for manufacturing cylinder blocks and heads in the mid 1960s.

10.3 Body Painting.

The new plant incorporated a unique "ROTODIP" paint process and was the first such installation in Australia and so far the only one. It was installed at a time when, world-wide, motor manufacturers were being criticised for early rust failure of their vehicles because of little or no internal corrosion prevention. The Rotodip addressed the problem by immersing the whole body in an anti-corrosion system, the final element of which was paint. The system was expensive to apply, but there is no doubt of its effectiveness as demonstrated by the high survival rate of the vehicles so treated.

Slat type floor conveyors provided a moving assembly bench. Elevated sections gave access to the underside of the vehicles without the limitations imposed by the construction of pits.

It was the overhead conveyors that delivered components to assembly locations that caught the eye. There were conveyors that brought components from the store and conveyors that brought components from sub assembly areas. These conveyors provided a tangle of green tracks which curved and swooped between the load points and the delivery points.

What was not immediately apparent was that the factory could not have functioned without the conveyors. It was not simply labour saving. The layout of the factory and the limited space around the assembly area would not allow the plant to function no matter how many operators attempted to fetch components from storage locations or how many fork trucks brought pallets of components.

The role of conveyors which were the arteries of the factories is treated in more detail in Appendix 4.

10.6 Flexible Manufacturing

The CAB was designed and operated so that a number of different vehicle models, each with a number of variants and trim quality levels and a range of interior trim colours and exterior body colours could be built in any sequence that the sales department specified on a day to day basis. Typically, three vehicle models were being built on any one day with up to 12 different paint colours and two trim levels. A model change could be implemented in a matter of a few months and thus the CAB imposed few limitations on model planning.

Flexibility was built into the layout of the Unit Plant, the main limitations being the transfer machines for major engine components. Even these machines, however, had development planned into them as they were, in 1961, developed to machine both four and 6 cylinder engine parts (originally only 4 cylinder parts) and later in the late 1960s developed further to machine an all new engine range - again both 4 and 6 cylinder engines. The assembly lines for power units, which were located in the Unit Plant, were also set up to cater for a range of different models simultaneously with a change over response time similar to that of the CAB.

The Press Shop was flexible in that, with a change of tools, it could make the body for any vehicle model. In that the economics of press run time limited the ability to change rapidly, the Press Shop was the least flexible of all the factories at Victoria Park. This is treated further in Appendix 1.

11. Local Content of Products Manufactured.

Local content is the proportion of the manufactured cost (at wholesale level) of the product that is Australian. In the 1960s and 1970s, several plateaus were common:-

> Typically a vehicle, that is assembled from mainly overseas components but with such things as batteries, tyres and soft trim items made locally, had a local content of about 45%.
>
> A vehicle that is manufactured from mainly Australia components but one major category of parts - the engine parts or the body panels - had a local content of about 85%.
>
> To achieve about 95% local content, a vehicle had to have both the engine parts and the body panels made locally as well as the vast majority of minor parts.

Shortly after the Victoria Park commenced manufacture of Morris, Austin and Wolseley cars, the local content was 98% - a truly historic achievement.

The local content varied over the years depending on model and was influenced by Government policy. Import duty concessions were granted, depending on the level of local content achieved, and the level required to achieve the maximum import duty concession varied over the 25 years that Victoria Park operated.

When the plant was at its most profitable, three models were being produced - Morris Mini, Morris 1100 and Austin 1800. In all these cases, the body panels were pressed locally and only the major power unit components were imported. The local content was about 85%.

In the late 1960s, Government policy changed and a higher level of local content was encouraged by import duty measures. Full manufacture at 95% local content attracted the maximum import duty relief while fully imported vehicles were heavily taxed. A "small volume" import scheme was initiated which allowed importers to bring in 7500 vehicles per annum without attracting the maximum duty. These changes influenced BMC, as it was then, to make model policy decisions which finally contributed to the closure of the plant.

13 Social Significance

13.1 Post War Reconstruction

The Victoria Park development into a vehicle manufacturing plant was a significant component in the post war reconstruction phase of Australia's history. It provided almost continuous construction work for a large workforce over the period of 1949 to 1959 and resulted in a significant technology transfer impetus to both the engineers and technicians at the plant and a wide range of suppliers. In this latter area, suppliers of both production equipment and components benefited.

13.2 Migrant Assimilation

Victoria Park was a real melting pot for the nearly 25 years of its operation as a car factory. The workforce was typically about 5,000 during this time - peaking at 7,000 - and the vast majority of the workshop floor personnel were migrants. Many of these could not speak English and their early instructions were often by sign language.

Over 35 languages were spoken in the plant and leading hands who were multi-lingual were used wherever possible. Employees were grouped to make communication easier but the English speaking environment assisted them to gain English speaking skills quickly. Among many initiatives BMC took was the sponsoring of English classes for its immigrant workers - an action that was applauded as both innovative and highly desirable at the time.

The migrants were immediately more adventurous in the food they ate than the locals who were introduced to exotic smells as the migrants found imaginative ways of heating their lunches - there being an abundant number of heat sources for those with initiative.

It was always a happy place to work. There were few incidents over the years and not one example of sabotage. Naturally many of the migrants stayed only a few years but this was accepted as they had made a contribution to the company and the company had helped the migrants start in their new country.

13.3 Employment Policies

Nuffield Australia, BMC Australia and later Leyland Australia had a very enlightened employment policy. Although not broadcast widely, there were always a number of ex-criminals who were given employment to assist them with their rehabilitation. Further, at a time when handicapped people were generally expected to work in sheltered workshops, at Victoria Park, tasks which could readily be carried out by handicapped people were offered to them.

The site was planned on a grid with long, wide, avenues between the buildings which gave a spacious feeling and very tidy appearance to the site. Coupled with the excellent material flow patterns that were integral to the site layout, it was an easy matter to maintain "good housekeeping" with the minimum of industrial clutter.

An example of attention to detail in the design of the buildings was the incorporation, in the Car Assembly Building, of escalators to the centrally located, overhead, toilet facilities.

When visited in 1998, shortly before their demolition, all buildings were structurally sound and still presented an attractive appearance.

Barry Anderson
Roger (Alan) Foy
Norm Prescott
Roy South

With special thanks to Owen McDonald

September 1999

APPENDIX 1

The Frankipile Process

A steel tube about 15 inches diameter and 30 feet long was stood vertically on the surface and a builder's barrow of coarse aggregate poured into the tube. A heavy steel bar (the tup) was positioned above the tube and dropped onto the aggregate. The aggregate formed a plug jammed against the walls of the tube and the sand below, and the plugged tube was rammed into the wet earth. At some point there was sufficient friction on the sides of the tubes for the hammer to cease and the tube was lifted to create a space under the tube. Further ramming drove the plug out of the tube. A very dry (low slump) concrete mix was poured down the tube and rammed until a mushroom foot was formed. The rammer was changed to a smaller diameter and a tube of steel reinforcement lowered into the outer tube. Concrete was again poured and rammed with the smaller steel bar which fitted inside the reinforcement. As ramming continued the outer steel tube was withdrawn and finally a reinforced concrete column was left in the wet sand.

A pile took about 40 minutes to drive and move to the next location.

Most buildings at Victoria Park had columns at centres of 60 feet (18.3 metres). Main factory columns had three 90 ton piles joined by a triangular cap.), while some locations had a single pile driven and capped with a small square cap. The closest pile centre distance was in the steel store in the Press Shop which had columns every 4 feet.

When the floor was cast and the building was finished the electricians were running conduit for lights, GPO'S and Distribution Boards. The locations of drilled holes were critical. It was agreed that holes 1/8 inch diameter could be drilled anywhere in the steel columns without seeking permission. Because of the stress placed on holes and the highly stressed components an electrician noticed and was alarmed when his drill went full depth in the column when he drilled a small hole. It turned out that the steel plate of the columns was full of laminar faults where steel mill slag had been rolled into the steel plate. The electricians drill went edge on into one of these laminations.

High frequency testing (today called ultrasound) defined the locations of these laminar faults. There was a greater area of faults than there was of reliable steel plate.

All these laminations were drilled through and plug welded until the columns had a reasonable beam strength and life went on. The columns never showed any indication of failure but columns never do warn of failure – they just go.

The pressings, stored for three months had to be protected from corrosion by spraying with protective oils. The three months aging also created removal difficulties in the Rotodip. Storage in low humidity, below 15% RH does not initiate corrosion. A proposal was put forward to seal the area and dehumidify the air as an alternative to the oil spray but was not proceeded with.

the appearance of the finished enamel. Any system of applying such pretreatment had to ensure that there was insignificant carry over of liquids from one section to the next

The only method (then and now) of applying paint to all parts of a motor body was a dipping process.

The application of finished enamel on top of this "primer coat" was a matter of showroom appearance, gloss retention and resistance to marring and chipping, not corrosion performance. BMC used stoving (baked) enamels for finish painting. So did Ford, Chrysler and Volkswagen. General Motors-Holden used lacquer finish. The first coat applied on top of the primer was a "primer/surfacer" which filled irregularities and was designed to be easy to rub flat and smooth using abrasive material. BMC used a sealer coat on top of the primer surfacer that ensured that the final coat of gloss enamel did not show variations in gloss caused by the texture of the substrate. Two tone vehicles were popular. BMC did not follow the trend to use metallic coloured paints until the 1970s. General Motors lacquer paint finishes worked a lot better with metallic finishes particularly in terms of rectification. Field durability was another question.

Painting of almost anything by dipping is difficult if the requirement includes both appearance and corrosion performance. The difficulty increases further with the complexity of shape and construction of the product being dipped.

Dip plants create paint runs which produce expensive preparation problems when subsequent paint coats are applied. The run is obviously thicker than the adjacent paint and may not be fully cured. Abrasive media used to remove the runs clogs on the undercured paint. Paint runs that stand out as obvious under a gloss enamel finish cannot always be seen in a dark brown dip coat. A lot of run removal was done on suspicion rather than on observation. The rubbing of the dark brown prime coat was done with air and electric sanders on the "black deck", at the start of the paint shop - a filthy job with a lot of labour turnover. The sanding (rubbing) of the primer surfacer coat was done wet with abrasive mesh discs driven by compressed air. This location was between two overhead stoving ovens and despite ventilation was oppressively hot and humid (from the wet rubbing). This was area of high labour turnover. Training was on the job in many cases with gestures rather than words for new migrants with no spoken English.

The paint used in dip tanks must be heated (stoved) to "dry" the paint after application. Apart from the chemical process that occurs, the paint solvents are released as the work is heated. This is obviously necessary and is not a problem if the solvent vapours can be removed as fast as they evaporate from the paint film. Complex spot welded assemblies do not heat up evenly, the thicker parts (e.g. the double thickness at joints) taking longer to come up to temperature. Inside box sections the solvent evaporating from thinner parts condenses on the cooler thicker parts and runs off, taking the deposited paint with it. This condition is known as "solvent washing". Solvent washing can remove all the deposited paint and leave the panel unprotected. On a joint

The body coming from the body shop was a "white metal body". There were no door locks or boot/bonnet locks (they would fill with paint). These panels were wired shut with soft welding wire. On one occasion a door came open and hung down as the body approached the stainless steel phosphate tank. The door propped the body enough to climb out of the drive dogs and the body was left suspended at the tank ledge. The next body pushed the disconnected body and spit into the tank and continued on until it jammed and the conveyor shear pin (a safety device) failed and the plant stopped. The stoppage cost half a days production. There were no other major failures with the plant in the period 1958 –1971.

Prior to pretreatment there was a manual solvent wipe using white spirit. This was designed to soften any pressing lubricants or preservative oils films on panels requiring the full colour enamel treatment. These panels were mainly outside but sometimes included some interior panels. This always remained necessary despite efforts to increase the strength of the cleaning process. Stronger cleaning liquids or more aggressive sprays produced a coarser phosphate crystal with paint adhesion problems.

The pretreatment was in five dip stages, each dip being supplemented with overhead sprays .The position of sprays was a concern initially and they were set in different positions to optimise the interior cleaning of the first bodies (The Morris Major) that were processed in the plant . There was less concern about the detailed position of these as the process was better understood.

The sprays and the agitation of the rotation were not as aggressive as a spray only type machines. Spray machines needed to deliver enough liquid to flush off grease in areas that were not directly contacted by the sprays. The submerged agitation of the Rotodip was more effective than sprays for enclosed areas and generally less aggressive cleaning could be utilised.

BMC always had the problem of manufacturing cars from panels that had been in storage for up to three months giving time for the pressing lubricants to harden. If it had been possible to paint panels within days of pressing the cleaning problems would have been much less. The five stages were:-

* Degrease in hot alkali detergent solution;
* Hot rinse in town water;
* Hot zinc phosphate;
* Hot rinse in water; and
* Acidulated chromic rinse.

At a point where the paint was "set up" and not capable of further flow the rotation ceased and the stoving continued in "road position"

The gases in the stoving oven were hot enough to melt the eutectic component of the "lead loading" used on one of the models that required lead (the Morris Minor). In normal processing this was not a problem but if there was a "stoppage" and the bodies were soaked in the oven this sag could be seen in the lead and those bodies required rectification.

On leaving the stoving oven there was a section where the underbody was sprayed with an air dry under body sound deadener.

Finally the body was de-spitted and transferred to an overhead conveyor which transported the body to the paint shop proper.

A separate conveyor took the spits back to the start of the Rotodip. There were about 18 spits on the return conveyor and about 60 within the plant. Spits collected paint drips and in time had to have the paint stripped in a caustic bath. There were enough spares to clean a portion on a regular cycle. The same caustic bath also cleaned the "Skuks" used to transport bodies within the paint shop.

The overhead conveyor that took the primed bodies was also a storage for about 60 minutes of production which allowed some cushion to prevent a minor stoppage in one section causing an immediate effect in the down stream section. This type of conveyor was known as "Power and Free" which allowed trolleys to be held at a location while loading and unloading continued.

Both the dry-off oven and the stoving oven were heated using light fuel oil (ships diesel) and heat exchangers. The pre-treatment tanks were steam heated with steam coming from 5 x 10000 pounds per hour steam generators. Some of this steam was used to condition air for spray booths but most was used in the Rotodip.

CONVEYORS

The spits were transported through the Rotodip by a pair of conveyors. There were three sets. One transported spits through the cleaning section. The second through the dryoff oven and the paint dip and the third through the paint stoving oven. Each section had a transfer point where the next "dog" picked up the spit within seconds of the first dog moving clear. A single line shaft ran down the side of the machine at about 500 RPM. Each conveyor was driven by a worm reduction gear box which provided the necessary increase in torque and the 90 degrees change in direction of rotation. Driven from a single shaft, there were no problems in timing dog positions for transfer. A fourth conveyor provided the moving rack which ran in the opposite direction to increase the speed of rotation after the paint dip. This too came off the single drive shaft. The main drive motor was about 5 kilowatt (7.5 HP) which always looked too small for the size of the installation. The spit return conveyor was a stand alone installation with no need to interlock with the Rotodip.

Bodies could not be accessed at the load point until they had dropped "out of the roof" from a feeder conveyor. There was no work station between the conveyor drop point and the location where the spit was inserted. It would have been much less fraught if the body was safely accessible for a couple of stations prior to being spitted. The preparation work could not be done in the Body (Press) Shop especially the solvent wipe which had to be wet when entering the dip. Bodies were on the conveyor overnight and over weekends. Solvent wiped bodies would have shown rust if wiped on Friday and processed on Monday.

The feeder conveyor was, as were all body conveyors, "power and free". Loading at the body shop end continued at the Body Shop cycle time (whatever the daily production rate). The cycle time of the Rotodip was determined by the chemical process involved. It ran at the same rate every day and controlled output by loading empty spits. The feeder conveyor could start the day full of bodies. As the day progressed the conveyor storage would reduce and then catch up again as the "meal break" was loaded. If the Rotodip over ran the supply of bodies they would load empty spits and lose that production opportunity.

At one time the motion of the spit truck was supplied by manpower.

About 1963 the spit truck movement (at both ends of the Rotodip) was powered. The powered movement took some pressure off the need to clean paint drips from the spits which jammed manual spitting and de-spitting. It also reduced the compensation injuries. Manual despitting was hard work for young men.

EFFECTIVENESS

Only Volkswagen produced a vehicle with the same level of corrosion performance. They used a structural floor pan as a chassis and painted this floor in a separate paint plant. They had no problems of runs or appearance with this component. The body

was painted without a floor and the technical problems of cleaning and dipping a body less floor were very simple.

Chrysler Valiant took a different approach. All vulnerable panels were reinforced with galvanised panels or zinc rich paint. They did a good job as evidenced by the number of early Valiants still on our roads.

Ford and GMH at that time were concerned with show room appearance at lowest cost. They both used "Slipper Dips" where the lower part of the car only was dipped. GMH then used a solvent hose to wash all visible dip paint from the panels which were to be painted with finish lacquer. The dip paint they used was incompatible with their Acrylic Lacquer top coat system. This hose also washed much dip paint from interior panels and the final durability was poor. The GMH front wings and bonnet were dipped and baked separately using a different paint.

CURRENT TECHNOLOGY

Every volume manufacturer now uses an electrically deposited water based paint as the first coat (the primer coat). The deposition process solves many of the performance problems of conventional dip systems as well as environmental ones. Electrocoat, as the process is mostly called, does not have the problems of runs or of solvent washing or of gravity creating a wedge shaped film. Being water based it does not present a fire hazard. It does have some problems of coating inside enclosed areas but the end user gets a standard of corrosion performance with a painted body that very few except BMC had previously approached.

been generous room around the tracks. Note that the space required to store and display was largely independent of the number of vehicles assembled. One a day or 90 per day called for a single location for most parts.

As an example, window glass was loaded onto a conveyor from the sub assembly area. An Austin Freeway Sedan had 10 pieces of glass. The same model as a Station Wagon had three more pieces that were specific to that derivative. The Morris Major had its 10. At one stage the Austin Farina AD08 was also being assembled with its 8 pieces. All these items were stored and accessed at a sub-assembly area which had to have fork access for pallet delivery. This significant area was arranged around the conveyor load point with provision for ensuring that the conveyors were loaded in the correct sequence to coincide with the vehicle model build sequence.

From another viewpoint, the walking distance for line operators to fetch material from line side storage locations would form a significant portion of their cycle time. Any operator on a moving conveyor had to walk from one vehicle to the next at the end of his cycle of work. BMC vehicles were mainly short but the track pitch was fixed to the longest vehicle. Car factories building longer cars would not build cars faster than 60 per hour on a single track. Any faster than that any the percentage of time spent walking from car to car was too big a proportion of operators time .

There were feeder conveyors carrying:-

* A basket containing all store small parts (which then travelled with the car);
* Bumper bars;
* Mufflers and exhaust pipe, steering rack, brake and fuel pipes, fuel tank;
* Wheel and tyre assemblies;
* Fascia and Steering Column assemblies;
* Glass;
* Soft Trim and door pads;
* Seats; and
* Batteries, radiator etc.

The CAB was set out with the paint plant (including the Rotodip) running almost the full length of the south wall. Immediately to the north of the paint plant was a series of four vehicle assembly tracks:-

* "A" Track closest to the paint plant onto which the painted body was lowered for the final assembly to commence;

* "B" Track (next to "A" Track) on which the final assembly continued and from which the partly completed vehicle was conveyed to a point mid way along "D" track;

* "C" Track (next to "B" Track) on which the final assembly was completed, the vehicle tested at a chassis roller station; and

A 4-5-8 chain could rise and fall through only a large radius and with long loads was limited to a small descent or rise angle (See below). This resulted in long areas under the descending and rising conveyor which could not be used for other purposes or even could not be crossed (say with fork trucks) without collisions. The solution to this was the use of expensive "dual duty" conveyors and equally expensive "drop section" which are described later.

The load on a conveyors usually hangs straight down from the trolley bracket. If the load is long and the slope of the conveyor is steep the front edge of the work approaches the chain on a descent (a fall) and this limits the maximum descent angle.

If the chain can accept a turning moment a rigid bracket can hold the load away from the chain on slopes. 4-5-8 chains could not accept a turning moment but the Fisher and Ludlow conveyor could and steeper rises and falls could be utilised.

Conveyors for car bodies were 4-5-8 style. Conveyors for components were the Flow Master type.

FISHER AND LUDLOW FLOWLINK AND FLOWMASTER CONVEYORS

These conveyor chains were bi-planar. Each pair of chain links was terminated at a swivelling "cruciform" which had two axles at 90 degrees each axle with two bearings. The chain could bend in both the horizontal and vertical planes.

The chain was supported between pressed steel side panels which in turn were supported by straddle brackets hung from overhead supports. Horizontal Bends were in pairs , an inner and outer. Vertical bends were identical as there was no need for LH and RH parts. Hanger Brackets bolted to the chain between bearings and carried the load.

Triangular sheet metal tube assemblies were the hangars to support the conveyor and these tubes had left and right hand threads which adjusted the tube length to trim the conveyor height.

The conveyor drive was a standard product and speed control obtained by pulley selection.

Installation of these conveyors was simple and the value recovered when the conveyor was relocated was high. Normally no welding was required.

The Dual Duty concept was available.

conveyor chain. The Drop Section needed to divert the main chain around the drop section and had its own short conveyor which dragged the loaded trolleys into the dropping section of track. Limit switches confirmed completion of sequences and the drop was automatic. There were 4 pairs of King Conveyor (4-5-8 chain) drop sections, The first in the Body Shop and rest in CAB:-

* Body Shop to CAB (Rotodip Load)
* Rotodip Unload to Paint Shop Entry
* Paint Shop Exit to Start A Track
* End B Track to D Track (Body Drop)

The Flowmaster Conveyor that brought the stores basket to the start of the Assembly A Track had a drop section at the start of A Track and a drop Section at the end of B Track where the empty basket was returned to store.

All Drop Sections had to sequence with the conveyor they were dropping to. Most dropped onto a raised platform which held the body a few inches above the conveyor pins. A final limit switch would "call" the platform and would drop the body accurately the last small distance.

The "D" Track Body Drop attracted a lot of interest as there was no intermediate platform. All body conveyors used two trolleys to support the load as much for stability as for strength. The drop section pulled the two trolleys into the dropping rail and waited to be "called" by limit switches on the floor conveyor. On call, the winch dropped at about 80 feet per minute and stopped above the heads of the operators and above the height of the engines and suspension located in their correct positions on the track. The body "hovered" at this position until a second call from a limit switch which initiated the final drop which placed the body on track supports. The drop position was very reliable. The Tasman Kimberly models dropped with 3/8 inch clearance around the engine with never a foul drop. Some of this clearance was taken up by the amount the floor track moved as the final two feet of drop occurred.

Each new model created its own set of problems on "D" Track. The "D" Track fixtures were the locating device for the displayed components. The new model had to be integrated with all the models that were continuing models. There were 41 stations on "D" track and 1 spare was always purchased for 42 total. This was always the largest single item of tooling for a new model in CAB

PAINT SHOP RESEQUENCE AREA

The Paint Shop conveyor system was not a single chain. There were 4 parallel spray booths with three return conveyors and transfers between each in turn.

The Primer Surfacer line was a single chain. The other three booths had a short chain in the booth itself with transfers either end. The short chain was to eliminate surge while the final colour was applied.

There was not a lot of underfloor work in a motor vehicle and only about half of "A" track and half of "C" track was elevated.

D track was elevated in that the track was at waist height. It was a single track about 30 inches wide. "A", "B" and "C" were twin tracks about 12 inches wide separated by about 36 inches.

The wide track allowed and operator to stand in front of the vehicle and lean over to connect engine mounts after body drop.
The waist height access at the sides allowed the suspension to be bolted and for rear wheel drive cars, the rear axle to be bolted up. Road wheels (and tyres) were fitted as the last operation on this track.

THE ROOF TRUSS

Very few looked at the roof truss and those that did look did not appreciate the flexibility that was available in that the roof could support services and medium weight structures such as conveyors without welded attachments or additional supports.

The column pitch was 60 x 60 feet centres. Main trusses ran from column to column. 4 subsidiary trusses ran between mains. The trusses were "N" type with the top and bottom chords parallel and 10 feet apart. Vertical members were spaced 7.5 feet apart on every truss. This resulted in panel points being located at 7.5 x 15 foot pitch. Each panel point had an extended gusset plate which was drilled on a standard pattern.

The CAB truss could accept 7.5 cwt (380 Kg) on each and every panel point – a live load of 7.5 pounds per square foot of plant area. The press Shop had a roof of an identical design which could carry twice the load. The CAB extension was designed at 30cwt at each and every panel point with specific points reinforced to 25 ton to carry the weight of paint ovens and water treatment plant.

The Body Shop utilised a standard hanger. The top had a plate that matched the gusset plate holes. The bottom had a square section that could be accessed on four sides. Steel beams could be suspended from these hangars to form a steel apron to which the spot welders were hung. Spot welders including the transformers and controls and compressed air and cooling water and lights all hung off the apron. A relayout with a new model would reuse all of these components without cutting and welding.

In the CAB the conveyors were hung from these panel points.

This design came from England. It is understood that it was the UK standard for new BMC factories. The roof was insulated, which did not help in Australia, especially in the CAB with the waste heat from the Paint Shop.